

COGNITIVE FUNCTIONS IMPROVEMENT IN MODERATE DEMENTIA PATIENT AFTER TWO-YEAR INTEGRATIVE TREATMENT AND COMPUTERIZED MEMORY TRAINING: A Case Study.

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INTRODUCTION

- The possibilities of cognitive rehabilitation in patients with cognitive impairment were the subject of investigations for many years (1, 3, 7, 8, 9, 14). The cognitive rehabilitation of medically ill patients with dementia has certain limitations.
- In our previous presentation, training attention and encoding memory (10 patients, for 6 months) increased brain speed and had a positive impact on other cognitive domains such as executive function (2).
- The purpose of this study is to look at one of the original ten patients over a longer period of time, 24 months, in order to see the brain's reactions to longer period of treatment.

METHOD

Subject:

- Patient S is a 77-years old female, Caucasian, with 10 years of education, right-handed, who came to our office with complaints of progressive memory decline and depression. Her medical history was remarkable for Hypertension, Arteriosclerotic Heart Disease, Hypothyroidism and Hypercholesterolemia. Her CT scan showed mild periventricular lucency, consistent with microangiopathic ischemia.
- She had been taking antihypertensive medications, and Synthroid prescribed by her primary physician. In our office, she was treated with Sonata, Ergotoid Mesitylate, Celexa, Folic Acid and Remenyl. She was also encouraged to take Vitamin E, DHA, Coenzyme Q-10, Multivitamins and to do mild physical exercises.
- Cognitive training was done by using Cognometer (software, developed by Cognitive Care Inc (www.cognitivecare.com) and CANTAB (www.cantab.com). Both programs were mostly used for training reaction time and encoding memory. Each session was 20-25 minutes long and consisted of training attention (test 1) and memory (tests 4 or 8). Sessions were provided once or twice a week. Computerized training was started after the first 6 months of treatment and continued for 24 months with several 2-3 weeks break periods.
- Neuropsychological test battery was administered at baseline, 6, 12, 24 and 30 months after initiation of treatment.

The following tests were used for cognitive assessment:

- A full version of the Mini-Mental State Examination (MMSE) (4).
- CANTAB, a computerized assessment battery (www.cantab.com).
- Neurobehavioral Cognitive Status Examination (Cognistat) was used along with MMSE to assess 10 cognitive domains: attention (digit span), orientation, language abilities, construction abilities, memory (four items), calculations, similarities and judgment (9).
- Ruff 2&7 Selective Attention Test was designed to measure short (2-4 minutes) sustained and selective attention on trials of visual search and cancellation tasks (12).
- The Intermediate Visual and Auditory Continuous Performance Test (IVA) was implemented for assessment of intermediate (about 25 minutes) sustain attention (13).
- Word List Memory Learning Test (WLMLT) was used to assess verbal memory. The WLMLT requires immediate free recall on a 10-item word list

presented in three separate learning trials. Delayed recall of the word list is tested after a 5-minute delay.

- Ruff-Light Trail Learning test (RULIT) is designed to measure visual spatial learning and memory, related to right hemisphere function (11). We analyzed immediate memory, learning process, and delayed recall (60 min).
- Word retrieval category animals and letter tests give information regarding frontal lobe verbal capacity.
- Ruff Figural Fluency Test (RFFT) provides information regarding nonverbal capacity of the right frontal lobe to produce unique designs (10).
- Wisconsin Card Sorting Test (WCST), computerized version, is used primarily to assess prefrontal cortical function, including working memory (shifting, abstraction, and responsiveness to feedback) (5).

RESULTS

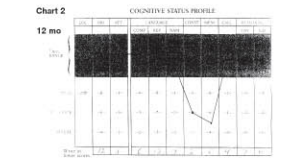
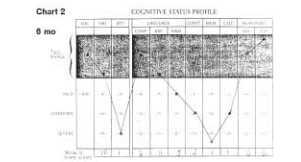
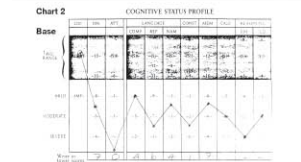
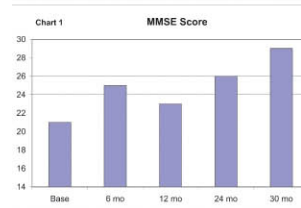
The patient's MMSE score was increased from 21 at baseline to 29 by 30 months of treatment (Chart 1). Reaction time was decreased (CANTAB, Table 1).

Table 1. Performance on Cognitive Tests after 24 months of Integrative Treatment

Tests		Base 6 mo 12 mo 24 mo 30 mo				
		Base	6 mo	12 mo	24 mo	30 mo
General						
MMSE		21	25	23	26	29
CANTAB Reaction time	5 choices movement time score		421			298
	5 choices reaction time score		1162			825
Attention						
Cognistat	Attention	0	1	8	8	8
Cognistat	Repetition	6	11	12	12	12
Cognistat	Calculations	1	1	4	4	4
2&7 Ruff Selective Attention	Automatic Detection Speech			114	129	120
2&7 Ruff Selective Attention	Automatic Detection Accuracy			90.1	84.3	93
2&7 Ruff Selective Attention	Controlled Search Speed			103	106	101
2&7 Ruff Selective Attention	Controlled Search Accuracy			91.2	82.8	92.7
IVA	Auditory Attention	91	94	96	89	84
IVA	Visual Attention	76	101	105	95	101
IVA	Auditory Focus	95	71	54	74	89
IVA	Auditory Speed	88	109	120	105	100
IVA	Visual Focus	69	97	101	93	113
IVA	Visual Speed	69	98	104	89	91
IVA	Hyperactivity	110	108	90	110	70
Memory						
Cognistat	Naming	4	5	8	8	8
Cognistat	Constructions	1	2	2	4	4
Cognistat	Memory	7	1	5	7	6
WCST	Categories Complete	4	2	2	6	6
WLMLT	5 minute recall	4	6	7	6	7
RULIT	Delayed Memory Correct	7	10	8	12	11
RULIT	Delayed Memory Errors	9	7	10	5	4
CANTAB PAL	Total Errors score			78		50
CANTAB PAL	Stages Completed score			8		8
CANTAB PAL	Total Errors (8 shapes) score			22		24
CANTAB PAL	Total Errors (8 shapes) score			44		24
Frontal Lobe						
Cognistat	Comprehension	4	6	6	6	6
Cognistat	Similarities	2	6	7	8	8
Cognistat	Judgment	2	6	6	6	6
Word Fluency	Letters	2	5	10	11	7
Word Fluency	Animals	4	13	12	12	14
RFFT	Unique Designs	33	37	57	35	59
RFFT	Perseverative Errors	12	26	17	6	17
RFFT	Error Ratio	0.39	0.72	0.22	0.17	0.29
WCST	Total Correct	97	62	99	95	94
WCST	Total Errors	31	66	29	27	22
WCST	Pers. Responses	19	52	9	11	16
WCST	Pers. Errors	18	45	9	11	12
WCST	Non-Pers. Errors	13	21	20	16	10
WCST	Conceptual Responses	87	44	92	94	90
WCST	Trials to Complete	23	11	65	12	12

Attention Domain

On the Cognistat attention, repetition and calculation subtests increased by 12 months and remained at the same level



until the end of 30 months (Chart 2). On sustained and selective attention tests, maximum improvement was observed by the end of 24 months. At the same time, by the end of 30 months there were signs of moderate hyperactivity.

Memory Domain

On the Cognistat, performance on naming, construction and memory (4 items) subtests increased by 12 months and remained at the same level at 30 months. Working memory (WCST), the number of complete categories decreased slightly by 6 and 12 months and then increased above baseline by 30 months. On the WLMLT we found increased performance after 6 and 12 months and then returned to base line. On the visual-spatial memory test (RULIT), the one-hour delayed recall showed an improvement by 30 months of treatment.

On CANTAB (PAL) the patient was able to finish 8 shapes after 12 and 30 months of the treatment. By 30 months the patient demonstrated improvement by decrease numbers of Total Errors (8 shapes) score.

Executive Function Domain

On the Cognistat, performance on comprehension, similarities and judgment subtests increased by 6 months and remained at the same level by 30 months. Word Fluency Test (letters and animals) showed progressive improvement up to 24 months, then continued at the same level for animals and decreased for letter), but remained above baseline. Unique design (RFFT) significantly increased by the end of 30 months. At the same time perseveration errors were also slightly increased with decreased error ratio. On the WCST we observed improvement, with total errors, perseverative responses, preservative errors, non-perservative errors, and trials to complete all decreased and conceptual responses remained about the same.

DISCUSSION

- This treatment brought together pharmacological, non-pharmacological interventions and computerized training. Interpretation of these findings should be done cautiously because of the complexity of different factors and level of cognitive impairment. From our experience, people with MMSE less than 15 are not good candidates for such training. We observed positive changes in all cognitive domains after 30 months of treatment (MMSE, Cognistat, CANTAB, Verbal Fluency Tests and WCST). Some positive effects were maximized by 24 months and then decreased (2 and 7 Selective Attention, WLMLT, RULIT, perseverations errors on RFFT). This means that there are certain limits in the rehabilitation of brain capacity. The most positive changes were observed in the executive function domain. Results on all frontal lobe tests were consistent.

- We found signs of hyperactivity and unchanged focus (IVA) by 30 months. This needs to be investigated separately for possible interfering factors (increase speed of cognitive processes, thyroid problems).

CONCLUSIONS

The integrative treatment of this patient with mild to moderate cognitive impairment and depression has prevented further cognitive decline and even showed improvement in different cognitive domains.

Further extensive research regarding cognitive rehabilitation for dementia patient needs to be done.

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